# PICONETWORK RADIOTELEPHONE INTERFACES FOR VEHICLES INCLUDING WIRELESS POINTING AND DISPLAY DEVICES

## BACKGROUND OF THE INVENTION

This invention relates to communications systems and methods, and more particularly to radiotelephone communications systems and methods.

Radiotelephone communications systems and methods are widely used for fixed and mobile wireless communications. As used herein, the term "radiotelephone" includes cellular and satellite radiotelephones with or without a multi-line display; Personal Communications System (PCS) terminals that may combine a cellular radiotelephone with data processing, facsimile and/or data communications capabilities; Personal Digital Assistants (PDA) that can include a radio frequency transceiver and a pager, Internet/intranet access, Web browser, organizer, calendar and/or a global positioning system (GPS) receiver; and/or conventional laptop and/or palmtop receivers or other appliances, which include a radio frequency transceiver.

## SUMMARY OF THE INVENTION

Embodiments of the present invention provide a radiotelephone interface for a vehicle that includes a steering mechanism and a windshield. Embodiments of the radiotelephone interface can include a pointing device that is configured to couple to the steering mechanism. A first wireless network interface is responsive to a radiotelephone being proximate thereto, to set up a first wireless piconetwork connection with the radiotelephone, and that is configured to wirelessly relay user pointing commands to the radiotelephone that is proximate thereto via the first wireless piconetwork connection. Embodiments of the radiotelephone interface also can include a display device that is configured to couple to the windshield. A second wireless network interface is responsive to the radiotelephone being proximate thereto, to set up a second wireless piconetwork connection with the radiotelephone,

and that is configured to wirelessly receive radiotelephone displays from the radiotelephone that is proximate thereto via the second wireless piconetwork connection, and to display the radiotelephone displays on the display device. The first and second wireless network interfaces may comprise first and second Bluetooth wireless network interfaces, respectively, and the radiotelephone itself may include a third Bluetooth wireless network interface. Radiotelephone interfaces according to embodiments of the present invention may be used to wirelessly relay user inputs from the pointing device that is coupled to the steering mechanism to the radiotelephone, and to wirelessly relay user displays from the radiotelephone to the display device that is coupled to the windshield.

## BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a block diagram of radiotelephone interfaces for vehicles according to embodiments of the present invention.

Figure 2 is a flowchart illustrating radiotelephone communications according to embodiments of the present invention.

Figures 3A-3C illustrate an example of radiotelephone communications in four- or more-wheeled vehicles according to embodiments of the invention.

Figures 4A-4C illustrate an example of radiotelephone communications in two-wheeled vehicles according to embodiments of the invention.

## DETAILED DESCRIPTION OF THE INVENTION

The present invention now will be described more fully hereinafter with reference to the accompanying drawings, in which embodiments of the invention are shown. This invention may, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth herein. Rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art. Like numbers refer to like elements throughout. It will be understood that when an element such as a layer, region or substrate is referred to as being "on" another element, it can be directly on the other element or intervening elements may also be present. In contrast, when an element is referred to as being "directly on" another element, there are no intervening elements present. It will also be understood that when an element is referred to as being "connected" or "coupled" to another element, it can be directly

connected or coupled to the other element or intervening elements may be present. In contrast, when an element is referred to as being "directly coupled" to another element, there are no intervening elements present.

Figure 1 is a block diagram of radiotelephone interfaces for vehicles according to embodiments of the present invention. Referring now to Figure 1, the radiotelephone interface **100** may be used with a vehicle **160** that includes a vehicle steering mechanism **120**, and a vehicle windshield **130**. Embodiments of the invention can be used to provide a radiotelephone interface for a radiotelephone **110** that wirelessly communicates with other wireless radiotelephones, wired telephones, computer devices and/or other devices, at least in part, via a wireless radiotelephone network, such as a cellular radiotelephone network and/or a satellite radiotelephone network.

Still referring to Figure 1, radiotelephone interfaces **100** according to embodiments of the invention include a pointing device **124**, such as a tactile mouse, that is configured to couple to the steering mechanism **120**. Thus, for example, when the vehicle is a four- or more-wheeled vehicle, the pointing device may be configured to couple to the vehicle steering wheel. Examples of pointing devices that are coupled to a vehicle steering mechanism, are described in U.S. Patent 6,240,347 to Everhart et al., entitled *Vehicle Accessory Control With Integrated Voice and Manual Activation*, and in U.S. Patent 6,226,570 to Hahn, entitled *Motor Vehicle With an Automatic Vehicle Driving and Electronic Communication Devices*, the disclosures of both of which are hereby incorporated herein by reference in their entirety as if set forth fully herein. The design of pointing devices that are coupled to a vehicle steering mechanism are well known to those having skill in the art, and need not be described further herein.

Still referring to Figure 1, a first wireless network interface **122** is responsive to the radiotelephone **110** being proximate thereto to set up a first wireless piconetwork connection **126** with the radiotelephone. The first wireless network interface **122** is configured to wirelessly relay user pointing commands from the pointing device **124** to the radiotelephone **110** that is proximate thereto via the first wireless piconetwork connection **126**. In some embodiments, the first wireless network interface **122** is a Bluetooth interface. As is well known to those having skill in the art, Bluetooth is a global standard that can eliminate wires and cables between both stationary and mobile devices, can facilitate both data and voice communication,

and can provide *ad hoc* networks that can be set up automatically and provide synchronicity between network devices. Bluetooth is described in detail at www.bluetooth.com, and is described generally in a publication by Haartsen, entitled *Bluetooth-The Universal Radio Interface for Ad Hoc, Wireless Connectivity*, Ericsson Review No. 3, 1998, pp. 110-117, the disclosures of both of which are hereby incorporated herein by reference in their entirety as if set forth fully herein. A mobile device that includes a Bluetooth interface also is described in U.S. Patent 6,255,800 to Bork, entitled *Bluetooth Enabled Mobile Device Charging Cradle and System*, the disclosure of which is hereby incorporated herein by reference in its entirety as if set forth fully herein. The design of short distance wireless networks (piconetworks) such as Bluetooth piconetworks are well known to those having skill in the art and need not be described further herein.

It also will be understood that the first wireless network interface **122** may be contained in a common housing with a pointing device **124** on the vehicle steering mechanism **120**, or may be linked to the pointing device **124** via a cable and mounted on or off the vehicle steering mechanism **120**.

Still referring to Figure 1, a display device **134** is configured to couple to the vehicle windshield **130**. A second wireless network interface **132** is responsive to the radiotelephone **110** being proximate thereto, to set up a second wireless piconetwork connection **136**, such as a second Bluetooth network connection, with the radiotelephone **110**. The second wireless network interface **132** is configured to wirelessly receive radiotelephone displays from the radiotelephone that is proximate thereto, via the second wireless piconetwork connection **136**, and to display the radiotelephone displays on the display device **134**. In some embodiments, the display device is a heads-up display that is configured to provide a display on the vehicle windshield. Heads-up displays also are described in the above-cited Everhart et al. and Hahn patents, and need not be described further herein. Moreover, the second wireless network interface **132** may be included in a common housing with the display device **134** and/or may be mounted separate from the display device **134** on or off the vehicle windshield **130**. Finally, it will be understood that the first and second wireless network interfaces **122**, **132**, respectively, may be included in a common housing that combines the functionality of the first and second wireless piconetwork connections **126**, **127**, respectively.

Still referring to Figure 1, the radiotelephone **110** also includes a third wireless network interface **112** associated therewith. The third wireless network interface **112** communicates with the first and second wireless network interfaces **122**, **132**, respectively, via the first and second wireless piconetwork connections **126**, **127**, respectively.

In some embodiments, the third wireless network interface **112** is a third Bluetooth interface. The third wireless network interface **112** may be combined in a common housing with radiotelephone **110** to provide a wireless communication device. In other embodiments, the third wireless network interface **112** may be contained in a separate housing that is permanently or semipermanently mechanically coupled to the radiotelephone **110** to provide a wireless communication device. For example, the third wireless network interface may be configured to clip onto the radiotelephone **110**. In yet another example, the third wireless network interface **112** may be contained within a cradle that is mounted within the vehicle **160**, which temporarily or permanently receives the radiotelephone **110** in the vehicle **160**.

Finally, still referring to Figure 1, other user interface devices **140** may communicate with the radiotelephone **110** using wired connections **142**. Still other wireless user interface devices **150** may communicate with third wireless network interface **112** using other piconetwork and/or Bluetooth connections **152**. The other user interface devices **140** and/or **150** can include a microphone, speaker, earpiece, printer and/or other user interface devices. It also will be understood by those having skill in the art that the first wireless network interface **122** and the second wireless network interface **132** can be combined into a single wireless network interface that is connected to both the pointing device **124** and the display device **134**, as well as to the other wireless user interface devices **150**.

As is well known to those having skill in the art, radiotelephones are often used for mobile communications in a vehicle, including a two-wheeled vehicle such as a motorcycle, and a four- or more-wheeled vehicle, such as an automobile or truck. When using a radiotelephone in a vehicle, it may be desirable to reduce or minimize distraction to the radiotelephone user while driving the vehicle. Thus, for example, it is known to provide speakerphones in vehicles for hands-free wireless communications. Other communications systems that can enhance safety are described in Swedish Application No. SE663A0, filed February 29, 2000, to Johan Ullman entitled *A Communication System for Vehicle, a Dialling Control Board, Use*

*of a Dialling Control Board and Method for Providing a Communication System for a Vehicle*, the disclosure of which is hereby incorporated herein in its entirety as if set forth fully herein. However, safety while operating a radiotelephone in a vehicle continues to be a concern.

Embodiments of the invention, for example as illustrated in Figure 1, can allow a vehicle operator to view a radiotelephone display and provide user pointer commands while maintaining the user's eyes on the vehicle windshield **130** and the user's hands on the vehicle steering mechanism **120**. Vehicle safety thereby can be enhanced.

Figure 2 is a flowchart illustrating radiotelephone communications according to embodiments of the present invention. As shown in Figure 2 at Block **210**, a wireless piconetwork connection is set up between a pointing device, such as the pointing device **124** of Figure 1, that is coupled to a steering mechanism, such as the steering mechanism **120** of Figure 1, a display device, such as the display device **134** of Figure 1, that is coupled to a windshield, such as the windshield **130** of Figure 1, and a radiotelephone, such as the radiotelephone **110** of Figure 1, in response to the radiotelephone being proximate to the pointing device and the display device. As shown at Block **220**, user displays are wirelessly relayed from the radiotelephone to the display device that is coupled to the windshield, via a wireless piconetwork connection. At Block **230**, user inputs are wirelessly relayed from a pointing device that is coupled to a steering mechanism to a radiotelephone that is proximate thereto, via a wireless piconetwork connection. At Block **240**, if additional displays or user inputs are desired, then operations at Block **220** and/or **230** are repeated.

Radiotelephone interfaces and radiotelephone communication methods according to embodiments of the present invention may be used in two-wheeled vehicles, such as motorcycles, three-wheeled vehicles and/or four- or more-wheeled vehicles, such as automobiles and trucks, and also may be used for radiotelephone communication applications such as caller identification and user dialing. These applications now will be described in connection with Figures 3A-4C, and may be provided using embodiments of Figures 1 and/or 2.

Referring now to Figures 3A-3C, radiotelephone interfaces and communications methods according to embodiments of the invention may be used in a four- or more-wheeled vehicle for caller identification and/or dialing. These

embodiments can provide, for example, a Bluetooth incoming call reception device and application, and/or a Bluetooth dialer display device and application.

Thus, an incoming radiotelephone call can be answered and/or an outgoing radiotelephone call can be initiated (dialed) without requiring the user to remove the user's hands from the steering wheel and also allowing the user to maintain eyes on the road. As was described above, the user's Bluetooth-equipped radiotelephone, such as radiotelephone **110** of Figure 1, can sync up with the vehicle's Bluetooth vehicle safety incoming call reception device and/or dialer device at any time when the user activates or moves the radiotelephone **110** within range of the vehicle **160**. Thus, a piconetwork is established to allow the devices to communicate.

Referring now to Figure 3A, a pointing device such as a tactile mouse button **324**, which may be similar to the built-in mouse interface that can be found on laptop computers and which may be an example of a pointing device **124** of Figure 1, is mounted in or on a vehicle steering wheel **320**. The mouse button **324** can be controlled by the driver's thumb, while the driver's hands still grip the steering wheel **320**. Referring now to Figure 3B, the vehicle windshield **330** includes a small translucent heads-up display grid **334** which can be built into the windshield and/or projected onto the windshield and which may be an example of a display device **134** of Figure 1. As shown in Figure 3B, the heads-up display **334** may be used to display the name and/or number, referred to as a "caller ID", of an incoming call, for example using embodiments of Figure 1.

Upon receiving an incoming call (radiotelephone communication), the caller's name and/or number are displayed on the heads-up display **334**, as shown in Figure 3B. Activation of the tactile mouse **324** of Figure 3A, for example to the right, can answer the incoming call. Otherwise, the caller may be directed to voicemail. Once the call is completed, the driver (user) can terminate the call by moving the mouse **324**, for example to the left. In some embodiments, the caller's name and number on the heads-up display **334** can disappear after a predetermined time, such as ten seconds, or after the call is answered. Accordingly, enhanced user convenience and/or user safety may be provided when answering a telephone call.

Referring now to Figure 3C, in other embodiments, the heads-up display **334** can provide a display of a keypad **336** and/or a mouse pointer **335**, to provide the driver with the ability to dial any number manually or to dial a number in the radiotelephone's phone directory or caller ID list, and thereby initiate radiotelephone

communications. The mouse **324** of Figure 3A may be used to control the mode and operations of dialing the radiotelephone. For example, moving the mouse **324** to the right can activate the heads-up display **334**, which can display in the directory/caller ID mode of Figure 3B. Moving the mouse **324**, for example to the left, can activate the heads-up display **334** to display in manual dialing mode of Figure 3C, where a keypad **336** is displayed on the windshield's heads-up display. In either mode of Figure 3B or 3C, the heads-up display can disappear after ten seconds of mouse inactivity.

Referring again to Figure 3B, in directory/caller ID mode, the mouse button **324** of Figure 3A may be pressed up or down to allow the user to scroll through the phone directory and/or list of names and numbers within the radiotelephone. In order to activate the dialing of a name or number that currently is being displayed, the mouse **324** may be pressed in.

Referring again to Figure 3C, in manual dialing mode, the keypad **336** can be displayed by the heads-up display **334** with a mouse pointer **335**, to allow selection of digits to dial a desired number or to terminate the communication (hang up). The desired digit or action may be selected by pressing the mouse **324**. Once the number is completed, the radiotelephone can dial that number. The hang-up button may be selected to terminate a phone call. Accordingly, enhanced safety and/or operational convenience may be provided.

Figures 4A-4C illustrate other embodiments of the invention that can provide incoming call reception and/or dialing systems and methods for two-wheeled vehicles such as motorcycles, for example using embodiments of Figures 1 and 2. It will be understood that user convenience and safety may be of particular concern for motorcycles.

Referring now to Figure 4A, a pointing device, such as a tactile mouse **424**, is incorporated within the motorcycle steering mechanism, such as the right-hand handlebar **420**, adjacent the throttle **426** and which may be an example of a pointing device **124** of Figure 1. Thus, the user can activate the mouse **424** while continuing to operate the throttle **426** and steering via the handlebars **420**. The tactile mouse may be controlled by the driver's thumb. A handlebar-mounted mouse is described, for example, in U.S. Patent 6,157,890 to Nakai et al., entitled *Motorcycle Navigation System*, the disclosure of which is hereby incorporated herein by reference in its entirety as if set forth fully herein, and need not be described further herein.

Referring now to Figure 4B, the motorcycle windshield **430** can contain a small display, such as a heads-up display **434**, which may be an example of a display device **134** of Figure 1. The heads-up display **434** can be used to display the name and number (caller ID) **438** of an incoming call. As shown in Figure 4C, the motorcycle helmet **460** can be equipped with a wireless headset device including a wireless microphone **462** and/or a wireless earpiece **464**, that can be used to communicate once the call has been established. It also will be understood that the display **434** of Figure 4B also may be displayed on the windshield **430'** of the motorcycle helmet **460**. When an incoming call is received, the user can move the tactile mouse **424**, for example to the right, if the driver wishes to answer the call. To terminate the call, the tactile mouse **424** may be moved, for example, to the left. The caller ID information **438** can remain visible for a predetermined time, such as ten seconds, or until the call is answered.

Still referring to Figures 4A-4C, in a dialing application, the driver can dial any number in the mobile radiotelephone's phone directory or caller ID list, or can dial a number manually. In this mode, a caller ID or phone list may be displayed, as shown at **438** and/or a keypad **436** may be displayed, as illustrated in Figure 4B. User operations may be performed similar to those described in Figures 3A-3C. Once the call is established, the microphone **462** and/or earpiece **464** may be used for communications.

In the drawings and specification, there have been disclosed typical preferred embodiments of the invention and, although specific terms are employed, they are used in a generic and descriptive sense only and not for purposes of limitation, the scope of the invention being set forth in the following claims.